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Thesis submitted in fulfillment
of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is my original work except for quotations and citations which have been used duly acknowledged as referenced work. I also declare that it has been previously, and is not concurrently, submitted for any other degree at Universiti Teknologi MARA or at any institution.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Past Graduate, Universiti Teknology MARA, regulating the conduct of my study and research.

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ABSTRACT

This research is divided into two main sections. Firstly, fourth order I2HM (4I2HM) and fifth order I2HM (5I2HM) are derived. Secondly, explicit and semi-implicit fifth order two-step hybrid method with first same as last (FSAL) feature are constructed and written as 5E2HMF and 5SI2HMF respectively. In order to analyze the stability of the new method, the second-order linear homogeneous test equation will be used. The numerical experiments are carried out using a wide range of problems. The criterion used in the numerical comparisons is absolute error and maximum error. The results are also compared to ODE23 and ODE45 which are the MATLAB's ODE solver functions. The interval of absolute stability for 4I2HM is found to be bigger than interval of periodicity for 4E2HM which is given by (0, 4.47). For fifth order methods, the interval of absolute stability for 5I2HM is found to be wider than interval of absolute stability for 5E2HM which is given by (0, 5.04). Next, for FSAL methods, the interval of absolute stability for 5E2HMF is found to be wider than the interval of absolute stability for 5SI2HMF which is given by (0, 3.96). The numerical results obtained showed that, the proposed methods are better than ODE23 and ODE45. The 4I2HM and 4E2HM showed that, both methods performed equally well. In addition, the 5I2HM and 5E2HM showed that, both methods have almost equal performances. Lastly, the 5E2HMF and 5SI2HMF showed that, both methods performed equally well. Hence, the new proposed methods can serve as alternative methods for solving special second-order IVPs.

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